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As part of the Articulated Instructional Media (AIM) program at the University of Wisconsin which is intended to extend higher education to people who would not otherwise have opportunities for study, the Library School program was conducted to develop independent study courses for the four beginning core areas of librarianship. The purpose of this present study was to evaluate the first segment of the cataloging course which was used in three library science programs. The experiment involved four classes in cataloging and classification in which the control groups were taught by regular instructors and conventional lecture-laboratory methods and the experimental groups used the materials developed for independent study. These materials consisted of a programed text, an index, a number of appendices, resumes of the materials programed, and a group of books assembled for use in the final session. It was concluded that: (1) the learning achievement of students using the independent study materials is sufficiently high to justify their use in teaching the same material now taught by conventional classroom methods, (2) students using the materials reacted favorably to them, and (3) retention of subject matter learned through independent study is not different from the retention of those students who had been taught in classroom situations. The attitude questionnaire showing student responses is appended. (JB)

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INDEPENDENT LEARNING MATERIALS IN LIBRARY SCIENCE INSTRUCTION:

A Report of a Series of Experiments on the Efficacy of a Programed Text Developed in the Articulated Instructional Media Program at the Library School of the University of Wisconsin

by

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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University of Wisconsin
Library School
Madison

1968

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The Articulated Instructional Media Program

In recent years, educators have shown considerable interest in developing more efficient learning materials for higher education courses and in making them available to people who could not otherwise carry on programs of study. In 1963, the Carnegie Corporation granted $387,000 to the Extension Division of the University of Wisconsin to institute an Articulated Instructional Media program. The two objectives of AIM are: first, to extend a college opportunity to the able high school graduate who cannot now pursue higher education, and to offer upper-division and post-graduate professional and technical work to the able adult who wishes to continue his or her education but cannot attend classes at conventional times and places; and second, to develop teaching techniques which place their emphasis on the learner— his needs and his achievement— rather than on traditional systems of presentation, yet which maintain the highest academic standards.

The AIM program proposes to use off-campus evening classes, tel-lectures, radio, TV, programed instruction, conferences, independent study, mobile libraries, field laboratories, and other forms; combine, or articulate, these various instructional media into course patterns that a student could pursue at his own pace, on his own schedule at a site of his own choosing without coming to the campus for a long period of time. By eliminating the cost of lengthy periods of campus residence and introducing flexible forms and times of instruction, AIM hopes to learn how to extend higher education opportunities to such students. Emphasis is placed on the learner and his needs, both academic and economic.

The Library School AIM Project

The program within the Library School was supported by an AIM grant to develop independent study courses in librarianship. These courses were to provide independent study of the four beginning (core) areas of cataloging, reference, library materials (selection), and library operations and management. This new program was "aimed at two major needs in library education: accessibility and improved instruction."[1] The objectives as given in the originating proposal were: "(1) recruitment of college-educated adults to librarianship where otherwise home duties or job would prevent the undertaking of professional study...; (2) improvement of instructional methods and materials for independent study...; (3) evaluation of independent study at the preliminary professional level in comparison with on-campus study in the same course areas; (4) preparation of the college-educated recruit in the essentials... at the sub-professional level...; and (5) experimentation with training college graduates who are now independent adults for a new career in libraries as library technicians."

The program got underway with the appointment of the present author in January of 1965. The first materials developed were for the introductory course in cataloging. John J. Boll, the instructor of cataloging at the Library School, and the present author, after examining the various possible approaches and many false starts, agreed that a programed text, especially modified to suit the material to be covered was a reasonable way to present certain aspects of the course. Because no satisfactory method of presenting certain exercises or "laboratory problems" could be devised, it was agreed that the programed text would be complemented with a set of carefully selected books to serve as examples of problems as they appear in real situations. The materials produced were used by the students enrolled in the Introduction to Cataloging course in the fall semester of 1966 at the University and the students were asked to comment on the use of the materials as a substitute

for the conventional lecture-laboratory pattern of instruction normally used to cover the same subject matter. These students were asked to record the time required to complete the material, fill in an attitude questionnaire at the end of the three week period, and make additional comments and criticisms. This was done in order to test the students' receptiveness to programed learning and to solicit recommendations for improvement of the course. By the following spring, the revised materials were ready to be tested in an experimental situation. These materials consisted of the programed text,[2] an index, a number of appendices, resumés of the materials programed, and the group of books assembled for use in the final session.

The purpose of the present study was to evaluate these materials and to determine students' reaction to them as an aid in the development of the remaining courses under the AIM grant. This report of the experiments conducted is not an evaluation of the AIM program at the University of Wisconsin Library School but only an evaluation of the first segment of the cataloging course when used in three library science programs. It is not intended as an evaluation of the cataloging courses as they are taught at the University of Wisconsin, the University of Wisconsin - Milwaukee, and the Wisconsin State University, Whitewater.

The materials are hereafter referred to as "independent study materials;" which have as their basic component, a text designed to instruct students in descriptive cataloging. A. A. Lumsdaine has defined programed instruction as the presentation of a subject in tiny fractions of the total in some pre-ordered sequence with intermitent exercises or problems at each step.[3]

The basic characteristics of programed instruction are:

1. The presentation of information and required frequent responses by the user;

2. Provision for immediate feedback to the user as to the appropriateness of his response;

3. The possibility of independent work and self pacing of progress through the material.

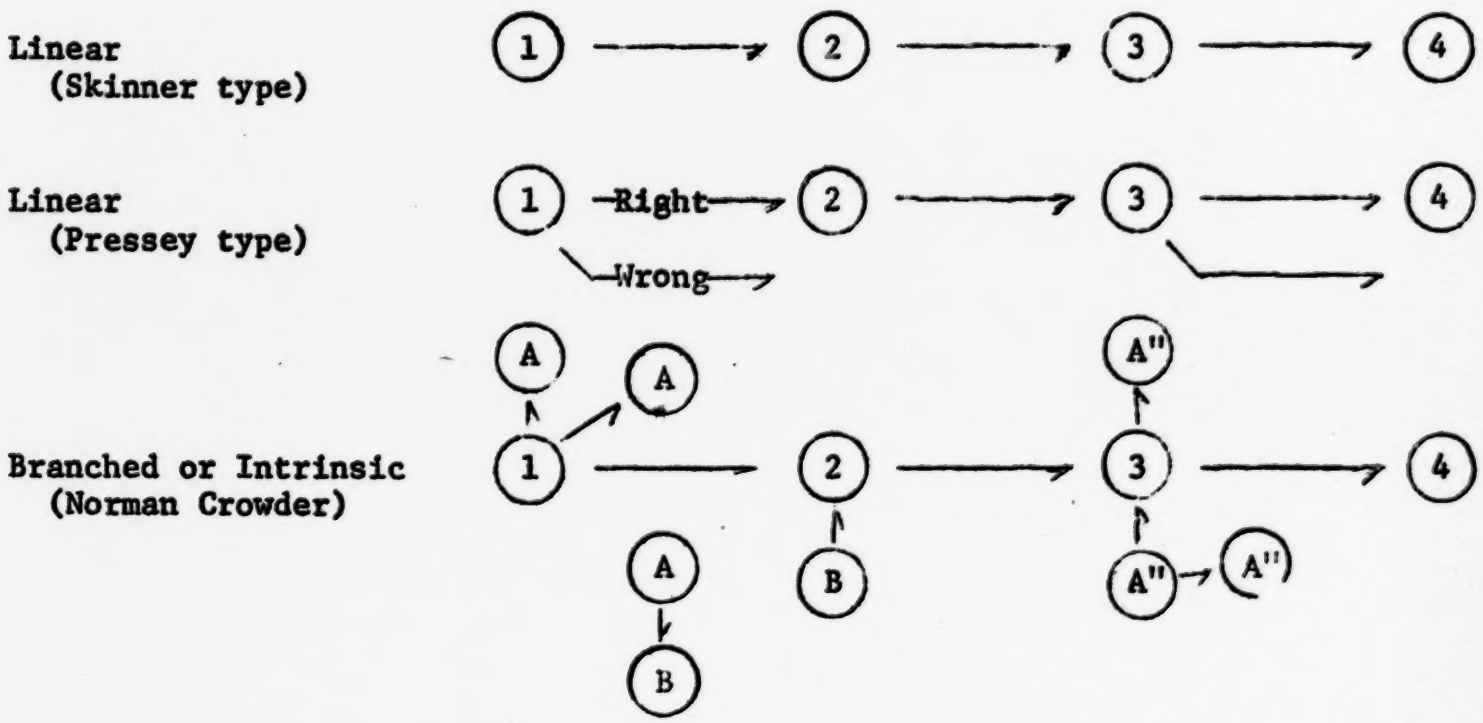
Two basic types of programed instruction have been developed. One is known as linear and the other as branched. Combinations or mixtures of these two basic types are also possible. Linear programing has two characteristics, (1) the information is presented in small steps (frames), and (2) all users read every frame of the program in the same (linear) sequence.. The user is presented small steps to minimize the error made in answering the question on the material contained in the frame. There have been two patterns developed within linear programing. One pattern in linear programing offers the user a multiple-choice. This multiple-choice programing is based partly on the concept of Sidney L. Pressey's that it is unimportant if the user makes errors while proceeding through the program because he is not permitted to advance to the next step until he knows (and selects) the correct answer. Selecting the correct answer "rewards" the user by advancement to the next step.[4]

B. Fred Skinner proposed that is now called the "contructed response" as the best application of linear programing. In a Skinnerian program, the user is required to complete a statement or answer a question ("fill in the blank") in his own words. Skinner reasoned that the process or recall is a more effective learning experience than is recognition, and that the actual act of responding tends to assist learning. The research conducted in recent years does not seem to indicate that either format has a distinct advantage.

The second type of programed instruction is called branched or intrinsic programing and was developed by Norman Crowder. When using a branched program, the learner does not necessarily follow the same sequence of frames that every other learner follows. Also, the response is used to measure the learner's knowledge

and comprehension rather than to reinforce the learning. Inappropriate responses are used to determine areas of misunderstanding or areas of weakness. Such errors determine remedial "branches for the learner, and when the misunderstanding is cleared up the learner is again returned to the main program and he continues through the material. Anytime the learner can demonstrate understanding of a concept within the material being covered he can be branched into more advanced material, and those learners who need it will be given smaller bits of information to permit complete comprehension of the details covered.

The basic types of programed instruction are diagramed below; the difference can be seen easily.



The text used in the experiment reported here is not a "pure" linear program nor is it a "pure" branched program. It is our belief that it does incorporate the basic characteristics of programed instruction as mentioned above, although a purist might say that it does not, strictly speaking, meet the criteria. However, it is a self-paced text designed to permit the user to work through as quickly or as slowly as he wishes. It will be seen in this report that some users finished the entire volume in one sitting of six hours and a few took as long as thirty-six

hours of study over a longer period in a number of study periods of various lengths. The material requires responses by the user after he has read a small amount of text and has studied the illustrations and examples. Furthermore, there is immediate feedback as to the appropriateness of his responses. Sometimes relatively large bits of information are given and then broken down into smaller bits; in other parts smaller detail is covered and then a larger concept is constructed from them, to then be checked for comprehension. The knowledge gained throughout the text is cumulative - each single idea builds on an idea or ideas previously gained. Exercises are also designed to be cumulative - each exercise testing not only the last bit of detail but that detail in the larger concept of which it is a part and/or in a more complex example incorporating previously learned material in a new combination.

The principle of programing that has been the guiding principle in the development of these materials has been that the materials dictate the format, that is to say, every attempt was made to select the format and the program technique that best suited the material to be presented. This report is the write up of the experiment conducted to determine if students could proceed through these materials and learn what we expected of students studying the same materials in a conventional (lecture-laboratory) classroom.

On the following pages are examples of some of the materials covered and how they were presented and tested. The examples are part of the section entitled "Parts of the Card." Two parts of the card are shown here, first the series note and then the dropped note. These are followed by the exercise covering these parts and the answer to the exercise.

SERIES NOTE

151.3
D481a
1964

Dethier, Vincent Gaston, 1915–
Animal behavior: its evolutionary and neurological basis [by] V. G. Dethier [and] Eliot Stellar. 2d ed. Englewood Cliffs, N. J., Prentice-Hall [1964]
viii, 118 p. illus. 24 cm (Foundations of modern biology series)
Bibliography: p. 111-112.

1. Psychology, Comparative. 2. Nervous system. 3. Psychology, Physiological. I. Stellar, Eliot, 1919- joint author. II. Title.

QL785.D5 1964 151.3 64—12157
Library of Congress [6614]

A book is frequently part of a series of publications. If this is the case, a SERIES NOTE is added to the collation in the second "paragraph" of the catalog card. The series note begins to tell something about the book's "bibliographic relationship" to other books. This information can be amplified, if need be, in the next "paragraph" or "paragraphs" which follow below the collation.

DROPPED NOTES

151.3
D481a
1964 **Dethier, Vincent Gaston, 1915–**
Animal behavior: its evolutionary and neurological basis [by] V. G. Dethier [and] Eliot Stellar. 2d ed. Englewood Cliffs, N. J., Prentice-Hall [1964]

viii, 118 p. illus. 24 cm. (Foundations of modern biology series)

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1. Psychology, Comparative. 2. Nervous system. 3. Psychology, Physiological. I. Stellar, Eliot, 1919– joint author. II. Title.

QL785.D5 1964 151.3 64—12157

Library of Congress [6814]

If a book is not part of a series, its descriptive cataloging may be completed with the collation. With this or the series note, the standard items needed to distinguish one book from another have been listed. However, if the cataloger feels features of this particular book significant for his patrons have not already been mentioned, these items may be noted in additional paragraphs of DROPPED NOTES. This term means, literally, that they are dropped below the body of the card. Here is the place to add special information or give explanations which may be necessary to clarify or supplement items in the main part of the card. Some of the items most frequently noted are contents and "bibliographic relationship to other works". (Was the book previously, or elsewhere, published under another title? Is it a translation? Is it a sequel to another work?) The DROPPED NOTE may list partial or full contents, just as shown on the table of contents, or may simply indicate some special feature such as a bibliography or an appendix. Following are a few examples of different types of DROPPED NOTES.

EXERCISE

(Practice in identifying series and dropped notes)

On the cards below, underline the series notes and circle the dropped notes.

Davis, James W 1920–
The Presidential primary, 1928–1960, by James Davis. [Minneapolis, ℗1962]

ix, 553 l.

Thesis—University of Minnesota.
Photocopy of typescript produced by microfilm-xerography. Ann Arbor, Mich., University Microfilms, 1964. 22 cm.
Bibliography: leaves [514]–532.

Daumier, Honoré Victorin, 1808–1879.
Drawings. Introd. by Stephen Longstreet. [1st ed.] Los Angeles, Borden Pub. Co. [1964]

[48] p. illus. 31 cm. (Master draughtsman series)

Dante Alighieri, 1265–1321.
The new life. La vita nuova. Translated with an introd. by William Anderson. Baltimore, Penguin Books [1964]

109 p. 19 cm. (The Penguin classics)

"L130."
At head of title: Dante.

, 1935– ed. and tr.

64–4332

De Young, Chris Anthony, 1898–
American education [by] Chris A. De Young [and] Richard Wynn. 5th ed. New York, McGraw-Hill [1964]

xvi, 538 p. illus., ports., maps. 24 cm. (McGraw-Hill series in education)

Foundations in education.
First ed. published in 1942 under title: Introduction to American public education.
Includes bibliographies.

1. Education—U. S.—1945– I. Wynn, Richard, joint author. II. Title.

LA210.D45 1964 370.973 63–22422

Library of Congress [9–1]

ANSWER TO EXERCISE

Davis, James W 1920–
The Presidential primary, 1928–1960, by James Davis. [Minneapolis, ©1962]

ix, 553 l.

Thesis--University of Minnesota.
Photocopy of typescript produced by microfilm-xerography. Ann Arbor, Mich., University Microfilms, 1964. 22 cm.
Bibliography: leaves [514]–532.

Daumier, Honoré Victorin, 1808–1879.
Drawings. Introd. by Stephen Longstreet. [1st ed.] Los Angeles, Borden Pub. Co. [1964]

[48] p. illus. 31 cm. (Master draughtsman series)

[L.]

NC1

Libra

Dante Alighieri, 1265–1321.
The new life. La vita nuova. Translated with an introd. by William Anderson. Baltimore, Penguin Books [1964]

109 p. 19 cm. (The Penguin classics)

"L130."
At head of title: Dante.

De Young, Chris Anthony, 1898–
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Research on Programed Instruction

Some attempts have been made to gather many of the, unfortunately, widely scattered research studies on programed instruction in convenient and available formats. The most useful compilations are the two volumes by Lumsdaine and Glaser,[5] Galanter's, Automatic Teaching,[6] and the June 1962 issue of the Journal of Educational Research (also published as a separate[7]). Wilbur Schramm has abstracted 190 research reports dealing with programed instruction.[8]

In general the results of the research on the effectiveness and value of programed instruction indicates the following:[9]

1. Students of all levels have indicated that they do learn from programed instruction; regardless of the form of that instruction (whether linear or branched, text or machine). There is no conclusive indication, however, that they learn significantly more than from other kinds of instruction; what improvement has been detected may be due to the Hawthorne effect (the challange to do well when encountering something new).
2. There appears to be no significant difference between programs requiring overt and covert responses, and a well written program put into good prose yields results no different from those achieved with the programed instruction.
3. Immediate knowledge of results does appear to contribute to learning according to most research, but the amount of such reinforcement is probably relevant to the type of program and apparently need not be the same for all programs.
4. Surprisingly, the research does not seem to support any significant advantage to programed learning in respect to the principle of self-pacing. A number of studies reveal no difference between individual

external pacing.

5. Finally, some research seems to indicate that prompting is superior to confirmation, which questions somewhat the general theory of reinforcement.

The Present Study

The present study indicates that the learning achievement of students using the independent study materials is sufficiently high to justify their use in teaching the same material now taught by conventional classroom methods. The study also shows that students using the materials reacted favorably to them. A further comparison shows that retention of subject matter learned through independent study is not different from the retention of those students who had been taught in classroom situations.

The experiment involved four different classes in cataloging and classification, two at the University of Wisconsin, one at the University of Wisconsin - Milwaukee, and one at the Wisconsin State University, Whitewater. Each class was divided into an experimental group and a control group, and each class was treated as an experiment independent of every other class. The control groups were taught by the regularly scheduled instructors, using the conventional lecture-laboratory sequence of instruction. The experimental groups used the material prepared for independent study under the AIM grant.

Specifically, the following hypotheses were tested: (1) there is no difference between the achievement level of students receiving instruction in cataloging by the conventional lecture-laboratory method and those receiving instruction through the use of independent study materials; (2) there is no difference between the retention level of students receiving instruction in cataloging by the conventional lecture-laboratory method and those receiving instruction through the use of

independent study materials. A second objective was to determine students' attitude towards independent study materials.

The limitations of the study were twofold, involving the sample and scope of the research. The students all were enrolled in the beginning cataloging courses at the three institutions during the spring semester of 1967. They were compared on the basis of selected characteristics considered important to achievement. Other factors that may be important, such as the teaching effectiveness of individual instructors or the regular attendance of students were not measured in this study. The basic measurement compared was scores on examinations covering the subject matter of the independent study text, that is, the general introduction and descriptive cataloging.

In order to control differences between the experimental and control groups of each class, two measures were used. Grade-point averages, expressed to the nearest one-hundreth, were obtained for all students. For undergraduates, the averages through the fall semester, 1966-67 were used and, for graduates, the averages for undergraduate college work. A second measure was a test of academic aptitude. For undergraduates, the Henmon-Nelson Ability Test (College Level, Form A) was used, and, for graduates, the Miller Analogies Test.

All students were given a pre-test to measure their knowledge before instruction. Following their completion of the study course, they were given a post-test to measure their learning. It was assumed that their gain in learning was the result of their study. Use of simple gain (or post-test score less pre-test score) would have had the effect of penalizing those students with high initial knowledge, since their total possible gain in learning was less than that of those with low initial knowledge. Therefore, the criterion used was "gain of possible gain" which is a ratio between actual increase in learning and total potential increase

considering the amount of initial knowledge. Gain of possible gain may be expressed mathematically:

$$\frac{\text{Post \%} - \text{Pre \%}}{100\% - \text{Pre \%}} \times 100$$

The analysis of the data required use of the technique of analysis of covarience. Controlling the factors of aptitude and academic ability through this technique on the basis of the scores on the ability tests and the grade-point averages, it was possible to determine the gain in knowledge in the four separate experiments.

A sample of twenty-three students enrolled at the Wisconsin State University, Whitewater in the beginning course in cataloging were the subjects for the first experiment. All students enrolled were used in the experiment, divided into an experimental group of eleven students and a control group of twelve students. The second experiment was made up of all students enrolled in the beginning course in cataloging at the University of Wisconsin - Milwaukee. The students were divided into an experimental group and a control group of twelve students each.* The third and fourth experiments consisted of students enrolled in the beginning cataloging courses at the University of Wisconsin. The undergraduate students were the subjects for the third experiment and the graduates were the subjects for the fourth experiment. There were seventeen undergraduates divided into the experimental and control groups of nine and eight students, respectively.

The three instructors were asked to cover the same instructional material as the AIM course in their usual sequence using the conventional lecture-laboratory method. The teaching methods employed by the instructors also differed and the emphasis on certain technical points were not always the same. Granting these

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* One later dropped the class

minor differences, the class experience of the four control groups and the four experiment groups was approximately the same.

For the four classes studied, the sizes were: 23, 17, 23, and 17. The sums and means of the criterion and control variables are shown in Tables 1, 2, 3, and 4.

TABLE 1

SUMS AND MEANS OF THE CRITERION AND CONTROL VARIABLES FOR BEGINNING CATALOGING STUDENTS AT THE UNIVERSITY OF WISCONSIN - MILWAUKEE.

Method of Instruction	Number	Gain of Possible Gain		Henmon-Nelson Scores		Grade Point Average	
		$\sum Y$	$\bar{Y}$	$\sum X_1$	$\bar{X}_1$	$\sum X_2$	$\bar{X}_2$
Normal	11	463	42.1	716	65.1	31.30	2.85
AIM	12	534	44.5	839	69.9	31.91	2.66
Total	23	997	43.3	1555	67.6	63.21	2.75

TABLE 2

SUMS AND MEANS OF THE CRITERION AND CONTROL VARIABLES FOR BEGINNING CATALOGING STUDENTS OF THE UNIVERSITY OF WISCONSIN - GRADUATE.

Method of Instruction	Number	Gain of Possible Gain		Henmon-Nelson Scores		Grade Point Average	
		$\sum Y$	$\bar{Y}$	$\sum X_1$	$\bar{X}_1$	$\sum X_2$	$\bar{X}_2$
Normal	8	351	43.9	450	56.3	23.34	2.91
AIM	9	446	49.6	534	59.3	28.84	3.20
Total	17	797	46.9	984	57.9	52.18	3.07

TABLE 3

SUMS AND MEANS OF THE CRITERION AND CONTROL VARIABLES FOR BEGINNING CATALOGING STUDENTS OF THE UNIVERSITY OF WISCONSIN - UNDERGRADUATE.

Method of Instruction	Number	Gain of Possible Gain		Henmon-Nelson Scores		Grade Point Average	
		ΣY	$\bar{Y}$	ΣX_1	$\bar{X}_1$	ΣX_2	$\bar{X}_2$
Normal	8	363	45.4	543	67.9	23.71	2.96
AIM	9	488	54.2	655	72.8	25.78	2.86
Total	17	851	50.1	1198	70.5	49.49	2.91

TABLE 4

SUMS AND MEANS OF THE CRITERION AND CONTROL VARIABLES FOR BEGINNING CATALOGING STUDENTS OF THE WISCONSIN STATE UNIVERSITY, WHITEWATER.

Method of Instruction	Number	Gain of Possible Gain		Henmon-Nelson Scores		Grade Point Average	
		ΣY	$\bar{Y}$	ΣX_1	$\bar{X}_1$	ΣX_2	$\bar{X}_2$
Normal	12	677	56.4	719	59.91	31.56	2.63
AIM	11	537	48.8	668	60.72	29.56	2.68
Total	23	1214	52.8	1387	60.30	61.12	2.66

A test of significance was made of the null hypothesis that students who receive instruction for the AIM programed materials independently do not differ in achievement in the beginning cataloging course from those students who receive their descriptive cataloging instruction in a conventional lecture-laboratory sequence. The analysis of covariance is shown in Tables 5, 6, 7, and 8.

TABLE 5

TEST OF SIGNIFICANCE OF INFLUENCE OF USE OF AIM PROGRAMED MATERIALS ON ACHIEVEMENT IN THE BEGINNING CATALOGING COURSE AT THE UNIVERSITY OF WISCONSIN - MILWAUKEE.

Source of Variation	Residuals		
	Degrees of Freedom	Sum of Squares	Mean Square
Within	19	638.45	33.61
Between	1	584.96	584.96
Total	20	1223.41	

$$F_{1,19} = \frac{584.96}{33.61} = 17.41$$

TABLE 6

TEST OF SIGNIFICANCE OF INFLUENCE OF USE OF AIM PROGRAMED MATERIALS ON ACHIEVEMENT IN THE BEGINNING CATALOGING COURSE AT THE UNIVERSITY OF WISCONSIN - GRADUATE.

Source of Variation	Residuals		
	Degrees of Freedom	Sum of Squares	Mean Square
Within	13	2923.00	208.79
Between	1	132.34	132.34
Total	14	3055.34	

$$F_{1,13} = \frac{132.34}{208.79} = 0.63$$

TABLE 7

TEST OF SIGNIFICANCE OF INFLUENCE OF USE OF AIM PROGRAMED MATERIALS ON ACHIEVEMENT IN THE BEGINNING CATALOGING COURSE AT THE UNIVERSITY OF WISCONSIN - UNDERGRADUATE.

Source of Variation	Residuals		
	Degrees of Freedom	Sum of Squares	Mean Square
Within	13	1909.15	146.86
Between	1	215.67	215.67
Total	14	2124.82	

$$F_{1,13} = \frac{215.67}{146.86} = 1.47$$

TABLE 8

TEST OF SIGNIFICANCE OF INFLUENCE OF USE OF AIM PROGRAMED MATERIALS ON ACHIEVEMENT IN THE BEGINNING CATALOGING COURSE AT THE WISCONSIN STATE UNIVERSITY, WHITEWATER.

Source of Variation	Residuals		
	Degrees of Freedom	Sum of Squares	Mean Square
Within	19	594.19	31.27
Between	1	1305.52	1305.52
Total	20	1899.71	

$$F_{1,19} = \frac{1305.52}{31.27} = 41.74$$

Results and Conclusions

The F-values given in Tables 5 to 8 are 17.41, 0.63, 1.47, and 41.74. The first and fourth F-values indicate differences in the gain of possible gain at the 5% level of significance. Therefore, the differences are large to conclude that they were undoubtedly not caused by sampling accident. We can assume that the difference could be attributed to the difference in mode of instruction. In those two cases, the null hypothesis was rejected and it can be concluded that the experimental students in the cataloging class at the University of Wisconsin - Milwaukee had better achievement records after using the AIM materials than those students in the conventional lecture-laboratory instructional group. Likewise it can be concluded that the students in the control group at the Wisconsin State University, Whitewater had better achievement scores than the students learning from the AIM materials.

The two remaining F-values indicate that the criterion scores (gain of possible gain) are not different at the 5% level of significance. That is to say, there are no true differences between the achievement of the groups in the two remaining experiments (both at the University of Wisconsin).

Retention

Retention of the learned materials was also considered important in determining the ability of students to learn from the independent study materials. A retention test was given at the end of May, approximately three months after completion of the instruction.

A few students dropped the class or were for various reasons dropped from the retention testing. The group sizes were as shown in Table 9.

TABLE 9

GROUPING FOR THE FOUR EXPERIMENTS FOR THE RETENTION TEST.

Group	Experimental	Control
UW - Milwaukee	12	11
UW - Graduate	9	8
UW - Undergraduate	8	8
WSU, Whitewater	10	11

The hypothesis tested was: there is no difference between the retention level of students receiving instruction in cataloging by the conventional lecture-laboratory method and those receiving instruction in the use of independent materials.

Comparison of mean gain of possible gain from the pre-test and retention test was made between the experimental and control group in each of the four experiments. The F-values for the four experiments are given in Table 10.

TABLE 10

F-VALUES FOR THE FOUR RETENTION EXPERIMENTS.

Group	F-ratio	Significant at the 5% Level
UW - Milwaukee	3.39	No
UW - Graduate	0.81	No
UW - Undergraduate	2.27	No
WSU, Whitewater	2.68	No

In each of the experiments on retention there was no difference between the means of the gain of possible gain (retention) of the control groups and the experimental groups at the 5% level of significance. Therefore, it was possible to accept

the null hypothesis that there is no difference between the retention of those students who received their instruction in the conventional lecture-laboratory method and those who received it from the independent materials tested.

Attitudes

Only summary, quantitative results of the attitude questionnaire are given here. The attitude questionnaire was designed to measure attitudes toward the use of independent study materials in general and toward the use of the independent study materials developed for the teaching of beginning cataloging on an independent basis specifically.

The materials used in the series of experiments were tried out on a class of approximately sixty students enrolled in the beginning course in cataloging at the University of Wisconsin Library School in the fall semester 1966. These students were not given pre-tests and post-tests but were asked to advise this researcher on ways to improve the materials used. They were also asked to complete an attitude questionnaire and the results of usable questionnaires are included herewith. The results are recorded separately for the fall semester students and the four experimental groups in the present study and also are recorded together.

Most items of the questionnaire were assigned values ranging from −2 to +2 for the five possible answers. Two examples are given below; −2 was assigned to the answer least favorable to the use of the materials, +2 was assigned to the answer most favorable to the use of the materials.

2. I enjoyed this manner of presenting instruction.

(+2)*	a.	strongly agree
(+1)	b.	agree
(0)	c.	undecided
(−1)	d.	disagree
(−2)	e.	strongly disagree

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* The weighting system did not appear on the questionnaire.

7. I would have preferred a standard textbook presentation.

(−2)* a. strongly agree
(−1) b. agree
(0) c. undecided
(+1) d. disagree
(+2) e. strongly disagree

Ten items were not weighted in the above described manner and the results of these questions are given separately. There were 28 items with weighted scales giving a possible favorable score of 56 and a possible unfavorable score of −56. The students were also given an opportunity to make any additional comments about the materials. Detailed scoring for each question is given in the Appendix.

Of the fifty-five students who completed the questionnaire after using the independent study materials the first semester and forty-three students making up the four experimental groups in this experiment the majority were emphatically and enthusiastically favorable in their added comments (see examples later). The scores based on the above weighted scoring technique also indicates favorable reaction to the material by the majority of the students completing the questionnaire. Summary statistics for the total scores are given in Table 11 below.

TABLE 11

MEAN, MEDIAN, MODES, AND RANGE GIVEN FOR THE 28 WEIGHTED QUESTIONS FROM THE ATTITUDE QUESTIONNAIRE.

	N	Mean	Median	Mode	Range	Standard Deviation
Experimental Groups	43	18.42	18	18	−23 to +51	12.29
First Semester Group	55	15.02	16	19	−15 to +37	11.93
Total of All Students	98	16.51	18	18	−23 to +51	11.72

* The weighting system did not appear on the questionnaire.

From Table 11 it can be seen that the students registered a strong bias in favor of the independent study materials tested.

The results for the ten unweighted (and therefore unscored) questions are also given the Appendix (being questions numbered 1, 8, 11, 14, 20, 22, 23, 30, 31, and 32.)

Additional comments from students from both groups were encouraging. One adverse comment was received concerning the amount of time it took to complete the independent materials. The time needed to complete the text was recorded by the fifty-five first semester students and the time ranged from six hours to thirty-six hours; seven students spent as few as six hours and one student spent thirty-six hours studying the text. The mean time spent by the students who recorded their studying time was 19.1 hours. The mode was 16 hours and the median was 19. There was no correlation between the number of hours of study and achievement as measured on the post-test for the fifty-five students in the first semester.

Before concluding this section on the attitudes of students towards the use of the independent study materials a recording of some of the statements returned by this group of students is useful.

"Generally, I thought the medium of instruction was excellent...."

"I really feel it has great possibilities."

"I was really excited over learning in this manner. I don't feel that this method is vastly superior to classroom work, but it does a fully adequate job of teaching.

"I thought the book was great— I enjoyed learning on my own time."

"I liked being able to study at my own pace and when I wanted to."

"I would like a combination of methods— independent study with a chance to discuss problems occasionally."

"I liked learning in this manner but there were times when I felt a discussion of the material would have been helpful. I enjoyed this type of learning."

"Keep up the good work. I really enjoyed this."

"... but I would have liked some oral explanation...."

"Feel an occasional classroom experience through the course would be helpful."

"Simply because no text is perfectly clear, this method is inferior to that of lecture-laboratory...."

Conclusions

It can be concluded from this experiment that independent study materials in a programed format properly used, can be the basis for satisfactory learning.

Statistically this study has shown that there is no difference in the level of retention between students who receive instruction in an independent programed format and those who receive instruction by the conventional lecture-laboratory method. In two of these four experiments it was further shown that statistically there is no difference in the gain of possible gain between the two methods of instruction. In one experiment the difference between the means of the control and experimental groups variable tested (gain of possible gain for pre- and post-tests) was different at the 5% level of significance, indicating greater achievement on the part of the control group receiving instruction by the conventional method. In another experiment the difference between the means was significant at the 5% level, indicating greater achievement on the part of the group using the AIM materials.

The text and other material tested in these experiments were the first parts of the now nearly completed programed text designed to permit a high degree of independent study by beginning students in library science. Certain modifications have been made in the presentation of data based on the present experiment and

practical considerations of production and utilization have forced minor changes in format, but the general techniques have been retained as we are convinced of their validity as learning tools. The present study has shown that independent study materials produce levels of achievement and retention that compare favorably with those obtained in conventional lecture-laboratory teaching situations at three different schools offering library science instruction.

The attitudes of students involved in the present study clearly have shown general acceptance of this method of instruction. Students often indicated they wanted more contact with their instructors but also felt a minimum of such contact would suffice to make the materials effective learning devices.

The single most difficult lesson learned in the preparation, testing and rewriting of these independent study materials was that each idea, each exercise, each illustration, each example, took a great deal more time to select and use advantageously than allowed for by our most generous guesses.

FOOTNOTES

[1]For details about this program see: Margaret E. Monroe, "AIM: An Independent Study Program in Library Science," Journal of Education for Librarianship, 6 (Fall, 1965), p. 95-102.

[2]Boll, John J. and Peggy O. Barry, with Richard D. Walker. Introduction to Cataloging, vol. I (Preliminary edition) (Madison, University of Wisconsin Library School, 1966).

[3]Lumsdaine, A. A., "The Development of Teaching Machines and Programmed Self-Instruction," New Teaching Aids for the American Classroom (Washington: U. S. Department of Health, Education, and Welfare, 1960), p. 139.

[4]Cram, David. Explaining "Teaching Machines" and Programming (San Francisco: Fearson Pub., 1961), p. 7.

[5]Lumsdaine, A. A., and Robert Glaser (eds.). Teaching Machines and Programmed Learning; a Source Book (Washington: Department of Audio-Visual Instruction, National Education Association, 1960-65). 2 vols.

[6]Galanter, Eugene (ed.). Automatic Teaching: The State of the Art (New York: Wiley, 1959).

[7]Lambert, Philip (ed.). The Teacher and the Machine (Madison, Wisconsin: Dembar Educational Research Service, Inc., 1962).

[8]Schramm, Wilbur. The Research on Programed Instruction (Washington: U. S. Department of Health, Education, and Welfare, 1964).

[9]Ibid., p. 2-15.

APPENDIX

Attitude Questionnaire After Use of Materials

(Showing results of student responses)

Your reaction to this experiment with independent study materials will be important in evaluating and improving the teaching of library science. This information will be used for research purposes only and will not be used to determine course grades.

Circle the letter before the statement that best represents your attitude in each of the thirty-eight items given below.

1.* At the beginning I

02[1]	05[2]	a. was not in favor of the use of the study materials.
12	17	b. would have preferred the "normal" classroom instruction.
22	10	c. was in favor of the use of the study materials.
19	10	d. preferred the study materials to the "normal" classroom instruction.
55	43	

2. I enjoyed this manner of presenting instruction.

29	58[3]	18	36[4]	a. strongly agree
21	21	21	21	b. agree
2	0	3	0	c. undecided
3	-3	1	-1	d. disagree
0	0	0	0	e. strongly disagree
55	76	43	56	

* Item has no value assigned.
1 Number answering from first semester.
2 Number answering from second semester.
3 Value assigned first semester.
4 Value assigned second semester.

3. Trying to replace the teacher and the classroom lecture-laboratory method is going too far.

1	-2	0	0	a. strongly agree
7	-7	8	-8	b. agree
10	0	8	0	c. undecided
30	30	18	18	d. disagree
7	14	9	18	e. strongly disagree
55	35	43	28	

4. I think this technique could replace instructors in this type of subject matter.

7	14	12	24	a. strongly agree
18	18	19	19	b. agree
8	0	5	0	c. undecided
16	-16	4	-4	d. disagree
6	-12	2	-4	e. strongly disagree
55	4	42	35	

5. Learning from Independent Study materials is all right for adults, but I don't want my children to have to use them.

4	-8	0	0	a. strongly agree
4	-4	3	-3	b. agree
8	0	13	0	c. undecided
19	19	16	16	d. disagree
20	40	11	22	e. strongly disagree
55	47	43	35	

6. I prefer this method to that of "normal" lecture-laboratory presentation.

5	10	12	24	a. strongly agree
20	20	15	15	b. agree
16	0	10	0	c. undecided
13	-13	4	-4	d. disagree
1	-2	0	0	e. strongly disagree
55	15	41	35	

7. I would have preferred a standard textbook presentation.

1	-2	1	-2	a. strongly agree
4	-4	2	-2	b. agree
3	0	6	0	c. undecided
31	31	20	20	d. disagree
16	32	12	24	3. strongly disagree
55	57	41	40	

8.* Given what I learn from the materials, I think the course was

0	1	a. much too long.
6	4	b. long.
39	33	c. about right.
10	3	d. short.
0	1	e. much too short.
55	42	

9. When the lecture-laboratory method is used with a teacher present instead of Independent Study materials

7	-14	3	-6	a. it is <u>much</u> easier to learn.
19	-19	7	-7	b. it is a little easier to learn.
19	0	22	0	c. it is about the same.
9	9	7	7	d. it is a little harder to learn.
1	2	0	0	e. it is <u>much</u> harder to learn
55	-22	38	-6	

10. In comparison with the lecture-laboratory method of instruction, the Independent Study materials made me feel

0	0	0	0	a. completely lost and unsure.
17	-17	15	-15	b. somewhat confused and unsure.
18	0	10	0	c. no different.
16	16	12	12	d. a little more sure of what I was doing.
4	8	5	10	e. a great deal more sure of what I was doing.
55	7	42	7	

11.* Compared to the lecture-laboratory method of instruction, I felt that the Independent Study method.

1	2	a. pushed me much too fast.
6	6	b. tended to hurry me a little.
45	33	c. allowed me to go at about the right pace.
2	2	d. slowed me down.
1	0	e. made me take much too much time.
55	43	

12. I learn something much better when someone talks to me about the material than when I only see it.

6	-12	2	-4	a. strongly agree
9	-9	12	-12	b. agree
16	0	16	0	c. makes no difference
20	20	7	7	d. disagree
4	8	5	10	e. strongly disagree
55	7	42	1	

13. The lack of opportunity to discuss a point with an instructor made the experience somewhat frustrating at times.

15	-30	5	-10	a. strongly agree
29	-29	24	-24	b. agree
7	0	8	0	c. makes no difference
4	4	4	4	d. disagree
0	0	2	4	e. strongly disagree
55	-55	43	-26	

14.* When I don't have a teacher to guide me and am on my own to go at my own pace, I tend to

2	1	a. go too fast.
7	5	b. hurry a little.
33	15	c. go at my best speed.
9	17	d. poke a little.
4	4	e. take more time than I need.
55	42	

15. I found the necessity of answering the exercises correctly before I could go ahead

0	0	0	0	a. was always a nuisance and really slowed me down.
2	-2	1	-1	b. was quite bothersome and often slowed me down.
3	0	2	0	c. never affected me in any way whatsoever.
27	27	18	18	d. was a help to learn and speeded things up.
23	46	21	42	e. was the biggest aid in getting to know what was wanted and I tended to learn rapidly.
55	71	42	59	

16. I discovered that instantly finding out whether I had done an exercise correctly

0	0	0	0	a. annoyed me greatly and was of no help in learning the material.
2	-2	0	0	b. was somewhat of a bother in learning the material.
3	0	0	0	c. didn't affect me one way or the other in learning the material.
31	31	19	19	d. helped me quite a bit in learning the material.
19	38	23	46	e. was the most helpful thing about learning the material.
55	67	42	65	

17. When I learned that an exercise was incorrect, quite frankly I felt that it

1	-2	0	0	a. discouraged me completely from wanting to try any more.
13	-13	4	-4	b. was a little discouraging.
1	0	2	0	c. didn't affect me one way or the other.
9	9	8	8	d. spurred me on a little.
31	62	29	58	e. encouraged me to dig in and find the right answer.
55	56	43	62	

18. The method of presentation increased by motivation to learn.

15	30	11	22	a. strongly agree
24	24	25	25	b. agree
12	0	5	0	c. makes no difference
3	-3	2	-2	d. disagree
1	-2	0	0	e. strongly disagree
55	49	43	45	

19. I don't think there was sufficient practical work.

20	-40	3	-6	a. strongly agree
26	-26	12	-12	b. agree
3	0	5	0	c. undecided
6	6	16	16	d. disagree
0	0	7	14	e. strongly disagree
55	-60	43	12	

20.* When I am learning something, I prefer to spend

1	1	a. no time working problems.
4	1	b. little time working problems.
33	33	c. some of the time working problems.
17	8	d. nearly all of the time working problems.
0	0	e. all of the time working problems.
55	43	

21. Too much material was presented in too short a time.

1	-2	2	-4	a. strongly agree
8	-8	7	-7	b. agree
9	0	5	0	c. undecided
32	32	24	24	d. disagree
5	10	5	10	e. strongly disagree
55	32	43	23	

22.* A criticism that could be made of the method of learning is that

3	0	a.	there was not nearly enough repetition of material.
21	13	b.	some material was not repeated as much as necessary.
14	18	c.	there was as much repetition as necessary-- (no criticism).
13	13	d.	some material was repeated a little more than necessary.
4	0	e.	there was entirely too much repetition.
55	43		

23.* As far as the amount of information to be learned from a single page was concerned

1	2	a.	there was an excessive amount on every page.
11	8	b.	there was a little too much at times.
29	29	c.	there was about the right amount
11	4	d.	there could have been a little more.
3	0	e.	there was not enough on every page.
55	43		

24. I sometimes felt that the material was difficult to read and understand.

1	-2	1	-2	a. strongly agree
18	-18	9	-9	b. agree
3	0	4	0	c. undecided
25	25	21	21	d. disagree
8	16	8	16	e. strongly disagree
55	21	43	26	

25. The words used in the material were a little too difficult.

0	0	0	0	a. strongly agree
1	-1	1	-1	b. agree
3	0	3	0	c. undecided
35	35	25	25	d. disagree
16	32	14	28	e. strongly disagree
55	66	43	52	

26. As far as I'm concerned, the <u>reading</u> of the Independent Study materials was

0	0	0	0	a. difficult all the way through the material.
9	-9	8	-8	b. difficult in places.
18	0	15	0	c. just about right.
20	20	13	13	d. easy most of the time.
8	16	7	14	e. easy throughout the whole course.
55	27	43	19	

27. I sometimes felt I needed a verbal explanation to give more meaning to the material.

5	-10	5	-10	a. strongly agree
33	-32	21	-21	b. agree
4	0	2	0	c. undecided
13	13	10	10	d. disagree
1	2	5	10	e. strongly disagree
55	-27	43	-11	

28. I felt quite comfortable learning in this manner.

19	38	11	22	a. strongly agree
29	29	24	24	b. agree
5	0	2	0	c. undecided
2	-2	5	-5	d. disagree
0	0	1	-2	e. strongly disagree
55	65	43	39	

29. When it came time for the examination, I felt that if I had had the "normal" lecture-laboratory presentation of the material instead of the Independent Study materials

2	-4	2	-4	a. I would have done much better.
12	-12	10	-10	b. I would probably have done a little better.
33	0	22	0	c. I would have done about the same.
5	5	6	6	d. I would probably have done a little worse.
3	6	2	4	e. I would have done much worse.
55	-5	43	-4	

30.* Learning through Independent Study materials may be all right for this kind of course, but I think the "normal" lecture-laboratory method would be best for learning something completely different.

5	1	a.	strongly agree
20	12	b.	agree
14	16	c.	undecided
11	9	d.	disagree
5	4	e.	strongly disagree
55	43		

31.* Usually, when I take a course, my aim is

8	8	a.	to be top man.
44	32	b.	to be above average
3	1	c.	to be average.
0	2	d.	to be below average.
0	0	e.	just to pass.
55	43		

32.* Learning in a competitive situation using Independent Study materials affords me the same opportunity to achieve my aim (as indicated in answer number 31) as when competing in a lecture-laboratory situation.

5	7	a.	strongly agree
40	19	b.	agree
4	11	c.	undecided
6	5	d.	disagree
0	0	e.	strongly disagree
55	42		

33. I feel I have really learned cataloging fundamentals.

8	16	6	12	a.	strongly agree
37	37	28	28	b.	agree
8	0	5	0	c.	undecided
0	0	4	-4	d.	disagree
2	-4	0	0	e.	strongly disagree
55	49	43	36		

34. I am doubtful about how long I will remember what I have learned.

3	-6	1	-2	a. strongly agree
8	-8	6	-6	b. agree
9	0	7	0	c. undecided
27	27	26	26	d. disagree
8	16	2	4	e. strongly disagree
55	29	42	22	

35. My performance on the test may indicate I have learned but I don't feel confident in being able to use my knowledge.

1	-2	4	-8	a. strongly agree
13	-13	7	-7	b. agree
6	0	6	0	c. undecided
25	25	21	21	d. disagree
10	20	5	10	e. strongly disagree
55	30	43	16	

36. I would be happy to receive more instruction in this form.

18	36	14	28	a. strongly agree
30	30	23	23	b. agree
3	0	4	0	c. undecided
4	-4	2	-2	d. disagree
0	0	0	0	e. strongly disagree
55	62	43	49	

37. This method has little value as a means of training.

1	-2	1	-2	a. strongly agree
0	0	0	0	b. agree
1	0	2	0	c. undecided
26	26	24	24	d. disagree
27	54	15	30	e. strongly disagree
55	68	62	52	

38. I think that I could perform as well on the test two weeks from now as I have today.

9	18	3	6	a. strongly agree
31	31	24	24	b. agree
7	0	13	0	c. undecided
7	-7	3	-3	d. disagree
1	-2	0	0	e. strongly disagree
55	40	43	27	